

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 10]

[1922

XLVI.—EFWATAKALA GRASS.

(Melinis minutiflora, Beauv.)

An interesting discovery that may prove of economic importance was reported by Mr. M. T. Dawe when, in 1921, he made an agricultural survey of Angola. The subject of stock raising has always proved difficult in western Tropical Africa and Mr. Dawe was consequently devoting much of his attention to this object. In the course of his travels he noticed a grass which was sought after by domesticated animals for fodder and yet at the same time appeared to be inimical or at any rate distasteful to the tsetse fly, a scourge against which little headway has so far been made in West Africa. This grass Mr. Dawe recognised as being similar to, if not identical with, the "Gordura" of Brazil or the "Yaragua" fodder grass of Colombia, in which country he had had practical experience of its utility for fattening stock.*

In both South American countries it is considered an excellent green fodder and appears to have the further property of being distasteful to ticks probably owing to the volatile oil exuded by the hairs on its leaves.

A previous notice of this grass appeared in *Kew Bull.*, 1900, p. 31, where, under the heading of "Brazilian Stink Grass" its introduction to the Botanic Gardens, Sydney, with a view to its distribution as a fodder grass, is described. It had been hoped that its property of supplanting forest and scrub by its thick mat-like growth would render it as valuable to Australia as it had proved in South America, but no further reports have come to hand as to any experiments which may have been made.

The specimens from the Lower Congo, submitted to Kew in 1921 by Mr. Dawe under the African names of "Lakamboma" or "Efwatakala," the latter name being in more general use inland, were determined as *Melinis minutiflora*, f. *inermis*. From the field notes accompanying the collections the grass is shown to be widely distributed in Portuguese Congo, not only on the plains but more especially on the higher ground from 2500 to

* For comparative analysis as a fodder see *Bull. Imp. Inst.* Vol. XX, No. 3, p. 300.

3000 ft. altitude. Some collectors report that its presence can be detected at once by the characteristic odour emitted, which is not unpleasant, other collectors state that they have always detected it first by sight, whilst in one report the odour of the grass, when grown in any quantity, is stated to be so offensive that human beings cannot live near it.

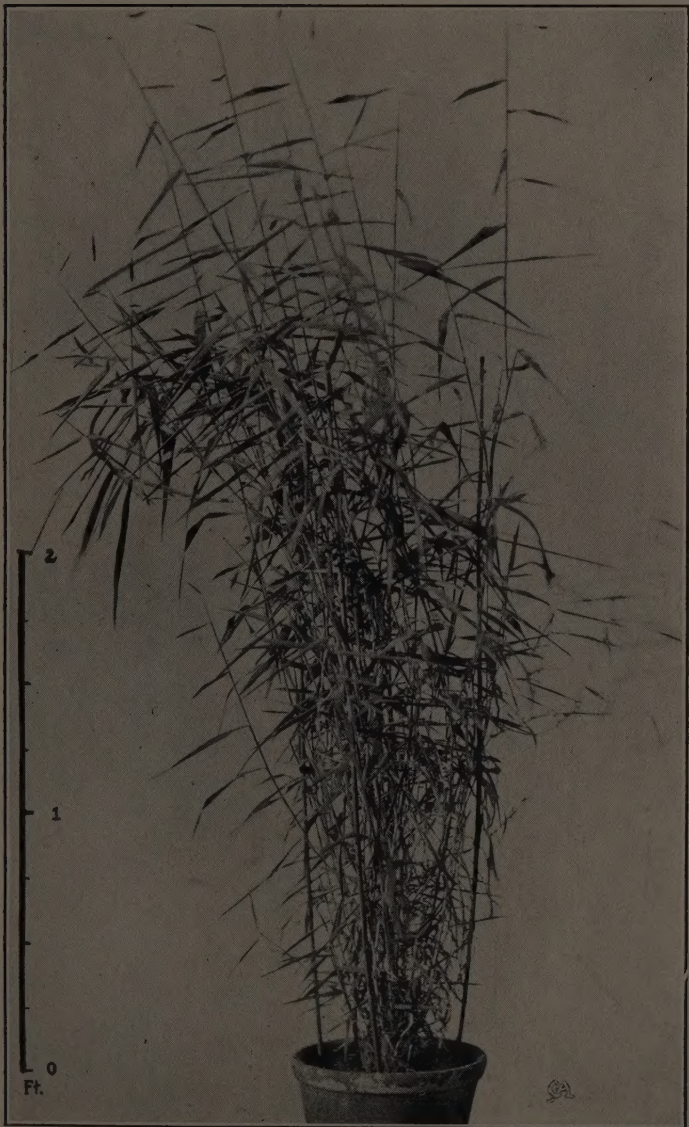
It is found growing with other and coarser grasses in virgin country, but on abandoned farm land Efwatakala rapidly spreads and establishes itself almost to the exclusion of all other vegetation. There seems no doubt that horses, mules and cattle prefer this grass, especially when it is young and tender, to the other grasses growing in association with it. In Angola from October to the end of May it forms an excellent pasture, and Mr. Dawe reports that in August, which is the dry season, it is often the only grass that retains its verdure on open and exposed dry lands.

But apart from this grass providing a pasturage, Mr. Dawe considers its bearing on the tsetse fly problem to be of even more importance, and it is mainly on this account that it has seemed desirable to give as full an account of it as possible in the *Bulletin*. He fully appreciates that it would not be a practical proposition to recommend dealing with heavily wooded areas or swamp forest, but in those areas which are less heavily wooded, the removal of scrub and trees and the initial planting of the grass will enable it to establish and maintain itself naturally in almost pure stretches. Such districts are found in the uplands of San Salvador do Congo, Canda and Damba, and there there would seem to be a definite possibility for converting fly-infested areas to cattle raising lands of first importance. There are suitable areas in Nigeria, the Gold Coast and Sierra Leone which, could the tsetse fly be eradicated, would enable the cattle industry to be developed to an important degree, not only as regards local consumption, but also in supplying steamers and even an export trade to Europe, whilst the employment of horses in areas, where they cannot live at present, would assist in the difficult problem of internal transport.

The method advocated for introducing Efwatakala is through a rotation of maize, cotton, beans or groundnuts, after which a sowing of the grass will enable it to be established; isolated trees and palms need not be cleared but the grass could be sown around them.

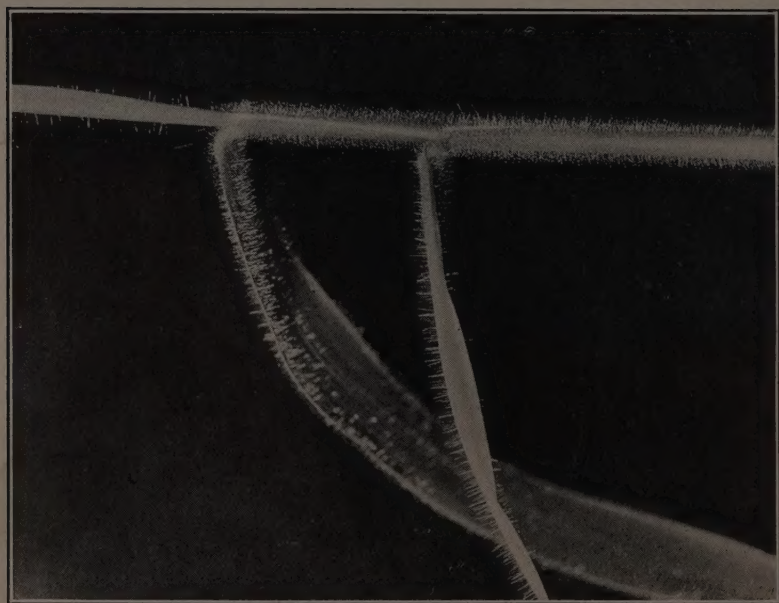
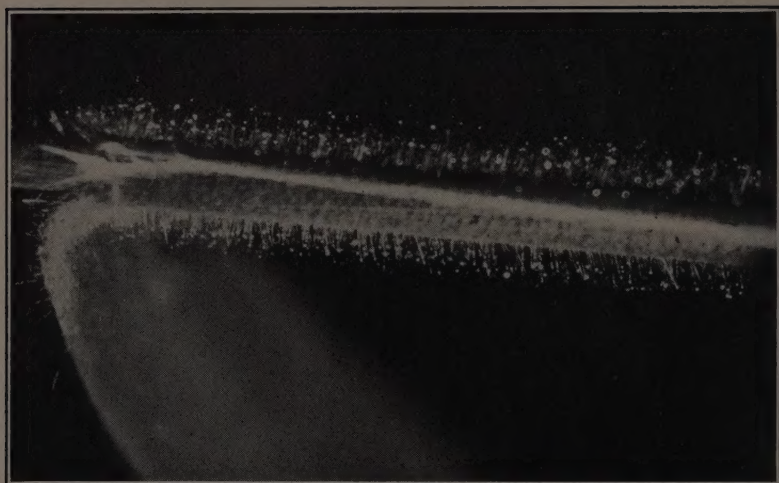
That the natives of the Portuguese Congo have a knowledge of its insecticidal and preventive properties is shown by their practice of making nests for their sitting fowls and using it as bedding for dogs when about to give birth to young, as it prevents the fowls and dogs being attacked by fleas. They also use the fresh grass for cleaning their clothes made from the fibre of the *Raphia* palm. In South America, as has been stated above, the grass is known to be repugnant to ticks, and cattle fed on this grass are reported to be much less subject to ticks although

PLATE I.



MELINIS MINUTIFLORA

[To face page 306.]



MELINIS MINUTIFLORA
Stem and leaf-sheath enlarged.

the meat and milk of such cattle has not any taint or suggestion of the characteristic odour of the grass, which is not unlike that of curry powder. The properties which render it objectionable to the tsetse fly are not only the strong odour of the viscid drops of oil exuded by the hairs on the leaf sheaths but also that they act in the capacity of a "fly-catcher," and as Mr. Dawe remarks if a big fly like the tsetse be ensnared, how much more would smaller flies be entangled, such as the mosquito, which would tend to shelter in the shady nooks of the grass tufts during the day time.

In contrasting the effect of Efwatakala with Citronella grass Mr. Dawe refers to the experiments he carried out in Uganda, where the planting of this grass, but perhaps more especially the clearing of the ground concomitant with the planting, did appreciably diminish the tsetse fly, and again in Ceylon where animals working among and feeding on Citronella grass escaped an epidemic of rinderpest which spread over a large part of the Island. Since Citronella grass, whose aromatic and oily properties are only noticeable when the leaves are bruised, has proved of service, he maintains that experimental planting of Efwatakala, in which the aromatic and viscid oil is exuded and exposed, is well worthy of serious consideration.

At Mr. Dawe's request, the Rev. R. H. Graham, of San Salvador, forwarded seeds of Efwatakala to Kew and from the plants raised the structure of the oil-containing hairs has been examined and the oil has been analysed. (Plate I.) Mr. Dawe also procured a small quantity of seed from Colombia,* some of which he took with him to Sierra Leone, the remainder, at the instance of Kew, was forwarded through the Secretary of State for the Colonies to Nigeria and Uganda, where it is hoped a sufficient stock of grass will be raised so that a series of experiments as to its efficacy may be carried out.

Dr. Stapf has examined the grass critically and has supplied the following notes :—

M. minutiflora, Beauv. became first known from Brazil. The earliest records from tropical Africa were supplied by Welwitsch's collections of 1854-1857, but they were not published until 1899. Welwitsch discovered the grass in the districts of Golungo Alto and Pungo Andongo in Central Angola. Next it was found on Kilimanjaro (first record 1884), on Ruwenzori (1893) and near Yaunde in the Cameroons (1890-1894). Quite recent records established its occurrence on the Ivory Coast, in Lagos, the Portuguese Congo and in or near the Mabira Forest in Uganda. Welwitsch describes it as growing in dense masses in Golungo, and Dawe found it to be very common on the Nkanda plateau

* Seed supplied by Mr. Dawe was sown in the open at Kew this year in June and attained a height of nearly two feet before it was killed off by the autumn frosts. At times its characteristic odour was very noticeable.

in the Portuguese Congo, whilst Scott Elliott points out that it is common in the forests of Ruwenzori between 6000 and 8000 ft.

The area inhabited by *M. minutiflora* in continental Africa may be described as consisting of two sub-areas, one in the West extending from Central Angola through the Portuguese Congo to the Cameroons with outposts in Lagos and on the Ivory Coast, the other in the East comprising the grassland on the slopes of Ruwenzori and Kilimanjaro and parts of the intervening country.

It was found in Ascension Island growing in great quantity between 1500 and 2500 ft. in 1889 and again in 1895, probably the result of casual introduction. A similar origin may be attributed to its occurrence in Central Madagascar, where it has been collected repeatedly since 1880.

In America the grass ranges at present, as far as we know, over the greater part of eastern Brazil (from Bahia and Goyaz to Rio Grande do Sul) and also occurs as a cultivated fodder grass in Colombia.

The genus *Melinis* consists of about a dozen species, all, except *M. minutiflora*, confined to tropical continental Africa. As to *M. minutiflora*, the question arises whether it is really indigenous in America or introduced. The problem was discussed many years ago by A. St. Hilaire, Martius and Gardner, who knew the grass in the field in Brazil. St. Hilaire and Gardner came to the conclusion that it was, at any rate in Minas Geraes and Goyaz, an intruder, whilst Martius considered it as native there. In the southern states it is either known to be cultivated (S. Paulo) or suspected as an alien (S. Catharina and Rio Grande do Sul). Engler more recently in his memoir on the affinity of the American and African floras admitted it as indigenous in Brazil. Its claim to being a genuine African grass has never been doubted, and its close affinity with most of the other species—all exclusively African—and the conditions of its occurrence in Africa afford sufficient proof. The problem has some bearing on the facility with which the grass spreads and establishes itself in certain circumstances and therefore on the chances of its introduction into regions not yet occupied by it or its cultivation. For this reason I may be permitted to quote from some of the authors mentioned above:—

M. minutiflora was first collected over 100 years ago somewhere in the neighbourhood of Rio Janeiro where it is common enough to-day. Subsequently in 1816, A. S. Hilaire came across it in the mining districts of Minas Geraes where it spread with great rapidity. This is what he says in "Aperçu d'un voyage dans l'intérieur du Brésil," 1823, pp. 8 and 9 (reprint):—"au bout de très-peu de temps enfin les arbres et les arbrisseaux ont disparu, et le terrain se trouve entièrement occupé par une graminée grisâtre, velue et uniflore, qui souffre à peine quelques plantes communes au milieu de ses tiges serrées, et qu'on appelle

‘capim melado’ ou ‘capim gordura,’ parce qu’elle transsude un suc abondant et visqueux. Plusieurs habitans désignent avec raison, sous le nom de ‘campos artificiaes,’ les pâturages dont je viens d’indiquer l’origine, et ils les distinguent ainsi de ceux du Rio-das-Mortes, qu’ils appellent par opposition ‘campos naturaes.’” Gardner who visited Minas Geraes in 1840 also discussed the problem and came to the same conclusion (“Travels in the Interior of Brazil,” p. 364), I quote from him :—“The hills around the Cidade de Serro are covered with a grass which the Brazilians call Capim gordura (*Melinis minutiflora*, Nees ab E.). It is covered with an oily viscous matter, and universally makes its appearance in those tracts which have been cleared of virgin forest for the purposes of cultivation; both cattle and horses are very fond of it, but although they soon fatten on it, the latter get short-winded, if they feed on it for any length of time. Martius* considers this plant to be truly a native of Minas Geraes, while St. Hilaire is of a different opinion; as it is now everywhere so common in this province, it is a difficult matter to say which of those excellent botanists is in the right; all the agriculturists that I have spoken with on the subject agree with St. Hilaire, although they differ in opinion in regard to the place of its original growth. It is only on the mountains that it is found covering large tracts, and at present it is rapidly extending northwards. St. Hilaire during his travels did not observe it beyond 17° 40’ of south latitude; but while crossing the Serra Geral from Goyaz to Minas, I met with it many degrees to the north of that parallel.† I noticed it only near houses, and there is little doubt that in the course of a few more years it will overrun that chain in the same manner that it has done those of Minas. The seeds have evidently been brought from the latter country by troops, which pass that way into Goyaz; it is not to be met with at all in the Sertão.”

Bunberry (Botanical Fragments, p. 103) has the same tale to tell. “The way in which this grass covers the ground (i.e. in Minas Geraes) continuously for leagues together to the exclusion of everything else, is very extraordinary.” I may finally add a passage from Van Delden Laerne’s “Brazil and Java,” p. 261 :—“Lands like these (that is, lands exhausted by rank grasses, as *Andropogon bicornis*, *Trachypogon plumosus* or by the bracken)

* I have not been able to trace in Martius a statement to that effect, unless it is taken to be implied in the following passage in his “Reise in Brasilien,” vol. i, p. 401 :—Unter den Pflanzen, welche auf diesem Gebirge wachsen, und besonders der Formation des Eisensteinflötzes anzugehören scheinen, bemerkt man auch in grosser Menge das Honiggras (Capim melado), das in Minas Geraes häufig vorkommt, und wegen seines zarten Baues und der öligen Haare, die es bedecken, das Lieblingsfutter der Pferde und Maulthiere ist, aber zu lange fortgenossen, sie dämpfig machen soll.

† Burchell collected the grass in 1827 in various places in the State of Goyaz between 19° and 16° S. Lat. and in 1828 as far north as Arrayos about 14° 40’ S. Lat.).

then are sown with the capim gordura (*Tristegia glutinosa**) a grass very much relished by cattle, which grows so dense and luxuriant that even the stubborn sape (*i.e.* *Andropogon bicornis*) must literally quit the field in this struggle for existence." It is clear from these extracts that in Brazil at any rate, this grass shows extreme aggressive powers on soil which has been disturbed and deprived of its natural vegetation, and there is no apparent reason why it should not behave in tropical Africa in the same manner whenever it gets a chance to do so, although it may be powerless among a vegetation in a state of established equilibrium.

In connection with the above Dr. Stapf considers the following remarks on two other species of *Melinis* worthy of notice.

Melinis effusa, Stapf.—This species is so far known only from Angola and the Lower Congo region. It was discovered by Welwitsch in "sandy wooded places" in Pungo Andongo and in "poor soil in sunny places" in Golungo Alto in 1857 and 1855 respectively. Then in 1900 J. Gillet found it near Kisantu and R. P. Butaye in the neighbourhood of N'Lemfu, both localities in the Stanley Pool Division of the Belgian Congo, and according to Dawe it is common in the Portuguese Congo. Nothing is known about its ecology or economic value, but in general appearance it is so much like *M. minutiflora* that it might be expected to behave similarly.

Melinis tenuinervis, Stapf.—Although this grass is not included under the general term Efwatakala as illustrated by Mr. Dawe's specimens, it may yet be useful to call attention to it, as it has apparently been mistaken by various authors for *M. minutiflora*—I myself described it originally as a variety under the name *pilosa*†—and replaces that species over a very large area extending from Southern Angola through the Southern Congo (Katanga) and Rhodesia to Natal and Nyasaland, whilst it resembles it sufficiently to suggest similar properties although the hairiness and viscosity of the plant is much less pronounced than in the two Efwatakala grasses. At any rate it might be taken into consideration as a possible substitute of *M. minutiflora* in districts which are not suitable for that grass. Unfortunately nothing is known about the ecology of *M. tenuinervis*.

The structure of the hairs has been worked out in the Jodrell Laboratory at Kew, by Mr. S. Dickinson, of the Imperial College of Science, with a view to ascertaining in what manner the oil was secreted. He reports as follows:—

"An examination by the naked eye shows the leaf sheaths enclosing the stem to be covered with hairs most of which, under a pocket lens, can be seen to have a drop of oil at the apex. The hairs are most numerous on the leaf sheath, but they also occur on both sides of the lamina. On the young sheaths whilst they

* A synonym of *Melinis minutiflora*.

† Flora Capensis, VII. p. 447.

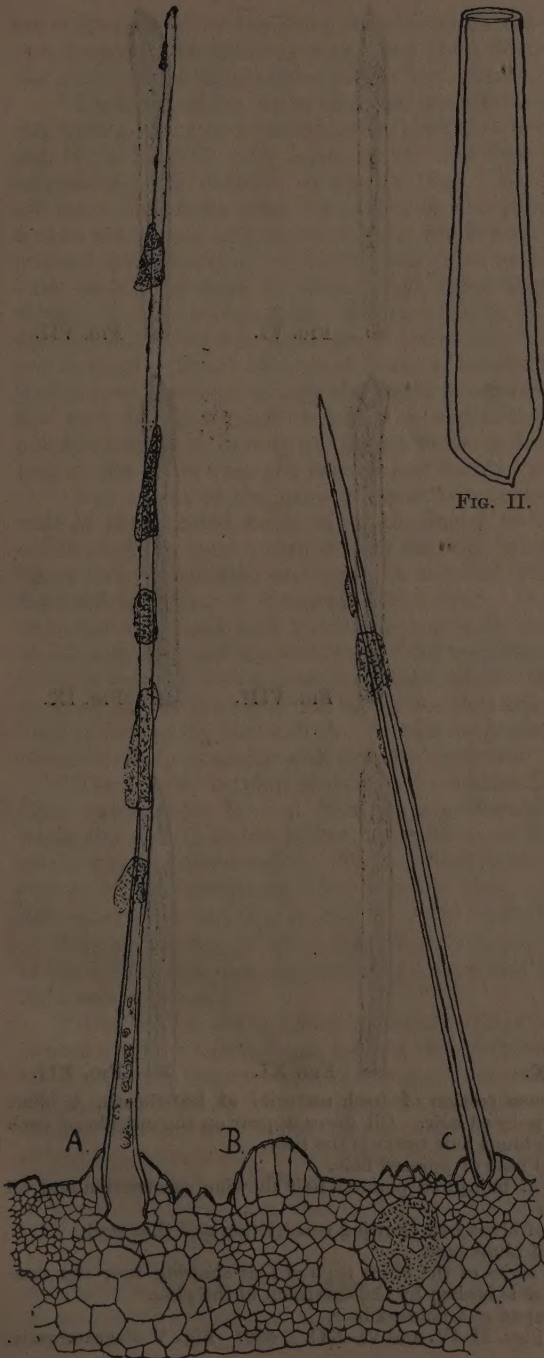


FIG. I.

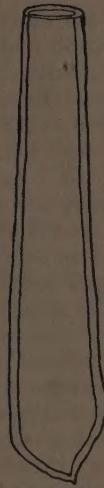


FIG. II.

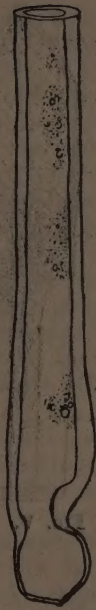


FIG. III.

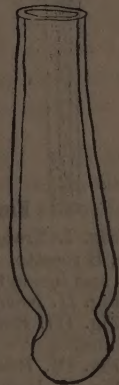


FIG. IV.

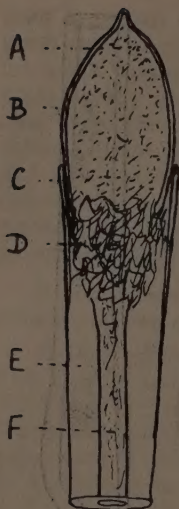


Fig. V.



Fig. VI.



Fig. VII.

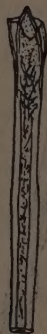


Fig. VIII.

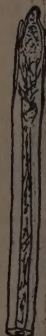


Fig. IX.

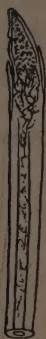


Fig. X.

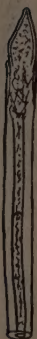


Fig. XI.

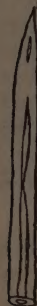


Fig. XII.

Fig. I. Transverse section of fresh material of leaf-sheath, A blunt hair, B rosette, C pointed hair. Oil drops appear on the outside of each hair and inside the blunt hair towards the base.

Fig. II. Normal base of pointed hair.

Fig. III. Base of uninjured pointed hair showing constriction and oil globules.

Fig. IV. Base of blunt hair showing constriction and thin wall.

Fig. V. Head of blunt hair.

Fig. VI-XI. A series of the blunt type of hair showing how the continuous cuticle layer is broken by the extrusion of the plug.

Fig. XII. The apex of a pointed hair.

Fig. I $\times 160$. Figs. II-IV, and VI-XII $\times 600$. Fig. V diagrammatic.

are still enclosed by the older ones the hairs are directed upwards or adpressed, but after exposure they point downwards; those on the blade are at right angles to the leaf surface. (Plate II.)

"The hairs, which are hyaline and unicellular, are of two types, one with a blunt or rounded apex, the other being sharp pointed (fig. i A and C). In both types the base of the hair is embedded in a cushion or rosette (fig. i B). The blunt hairs are more numerous than the others on the young sheaths whilst on the older ones only pointed hairs are found. At the first the pointed hairs are on the whole not quite so long as the blunt hairs which measure 1.15mm., but later they slightly exceed them. In the young stage the two types of hairs cannot be distinguished, but when mature, so far as can be ascertained, they are distinct. In all the blunt hairs a constriction of the wall occurs near the base, giving the latter a somewhat bulbous form. the wall being thinner below the constriction (fig. iv). The pointed hairs may or may not have a bulbous base (figs. ii and iii), and in the latter case the base is less deeply embedded (fig. i C).

"The apices of the hairs of these two types are distinct, the wall of the pointed hairs being thickened so that the lumen is obliterated for some distance from the top, while the apex of the blunt hairs is swollen and ends in a small knob. In fig. v is depicted the apex of a mature blunt hair. In the lower part is seen the thick cell wall E, and lumen with content F. Higher up the contents and the wall, except for an outer sheathing layer C, become merged into a granular mass, above this a more homogeneous part A is seen which resembles the cork of a bottle whose neck is formed by the wall C. At this stage the structure can be determined by staining with Schultz's solution

"The 'cork' or plug is stained a cellulose blue, it has a clear blue outer layer B, and from its appearance is mucilaginous; while the wall C stains yellow, and the mass D passes from blue at the top to yellow below. The cell wall lower down E, is yellow except for the innermost layer which is blue. At the base of the hair where the wall is thin (fig. iv) a blue colour is obtained.

"The reactions of the pointed hairs to stains agree with those of the blunt hairs, the base staining yellow and the apex blue with Schultz's solution.

"The wall is not lignified in either type of hair. With iodine it stains yellow throughout, and on the addition of sulphuric acid the inner layer becomes blue and thus appears to consist of cellulose. With ferric chloride the lower and outer parts of the wall were stained red-brown. With the xanthoproteic reaction, an orange colour was obtained in the walls from the base up to $\frac{2}{3}$ of the length of the hair, and the same part was stained red with Millon's reagent. This reaction must be due to some infiltrating substance, the nature of which has not been determined.

"On treating a mature hair (fig. vi) with concentrated sulphuric acid and also by staining with Sudan III there is found to be a layer of cutin on the outside, this was not observed below

the constriction at the base nor on the plug, but as far up as the base of the latter. The stage in fig. vi. shows this cutinous layer covering the apex and in figs. vii.-xi. the plug is shown being pushed through the terminal cap of cutin, thus the blunt hairs start with a complete covering of cutin, and later, just before or just after they are exposed by the growth of the leaf sheath on which they are seated, this cap is broken through, and the plug projects. It is not till this stage is reached that any external oil is found. After this stage oil is to be seen both on the blunt and pointed hairs. There is nothing to indicate that oil is excreted from the pointed hairs, and the oil occurring on them is regarded as having come from the blunt hairs during inclosure by the next older leaf sheath. In the mature blunt hairs oil is seen in the cavity at the base in the form of globules, and also towards the apex, and in the lumen from about $\frac{2}{3}$ of the length to near the top of the hairs there is a refractive substance whose nature was not determined. In the mature pointed hairs a certain amount of oil was found (fig. iii.), but in no other part of the plant was any oil detected.

"It cannot be supposed that the oil escaping from the hairs would pass through the lateral walls, and it is questionable whether the oil escaping from the blunt hairs could permeate the plug at the top of the hair, it seems more likely that the plug may act like the loose stopper of a bottle and allow the oil to ooze out between it and the wall. It was found in staining the contents of the mature uninjured hairs, that the stains were able to penetrate through the base of the hairs faster than through the apex.

"From the foregoing it would appear that the oil is secreted only in the two types of hairs, and that it is from the blunt hairs only that it escapes just after the continuous cutinous cap is broken and the plug extruded. The cap appears to be broken just before or just after the hairs become exposed and it is conjectured that the oil is enabled to pass out by the temporary lifting of the plug."

The oil of the grass was examined at the Wellcome Chemical Research Laboratories by Dr. T. A. Henry, who kindly supplies the following results of his investigations:—

"The material examined consisted of fresh plants grown at the Royal Botanic Gardens, Kew, and included the following samples.

- a. grass grown in pots or boxes under cover, 12 pounds.
- b. grass grown in the open, 30 pounds.

"Both samples have a characteristic aroma, recalling that of cumin seed, which is no doubt the odour which Mr. Dawe, in his memorandum on the grass, describes as similar to that of curry. The aroma seemed to be much stronger in the plants grown under cover than in those grown outdoors.

"The substance to which the odour is due is exuded as a yellowish oil from glandular hairs, which are easily visible on

the stems of the fresh plant and as the number of these is not great, it was realised that the yield of oil would be small. An attempt was made to collect the oil on absorbent cotton wool, and then to recover it from the latter by steam distillation. This answered well for small quantities of plant, but it took up too much time and led to serious loss by volatilisation when quantities of more than 50 to 100 grammes of plant were worked up.

It was therefore arranged that the two supplies of plant should be received from Kew as early as possible in the day and steam-distilled the same day. The distillation waters from the two lots of plants were again steam-distilled next day to concentrate the oil as far as possible but even then the distillation waters were only faintly cloudy and there was no actual separation of oil. They were therefore saturated with salt and extracted with ether, the ethereal solution dried, the solvent distilled off, and the residue, after drying in a vacuum chamber at atmospheric temperature, weighed as oil. The yield of oil from lot *a* was 0.06 grammes and from lot *b* 0.11 grammes, equal respectively to 0.001 and 0.0008 per cent. expressed on the plant as received.

"The oil was brown in colour, had a consistence similar to that of soft paraffin, showed a tendency to crystallise when the vessel containing it was placed in ice and salt, and had the characteristic odour of the fresh plant. It was acid to litmus, and required 1.18 per cent. of its weight of caustic soda to neutralize it. The soluble sodium salt so formed was washed out with distilled water and the residual oil collected. It still had the characteristic odour of the fresh plant and was now boiled for one hour with alcoholic soda, the alcohol removed under a low pressure and the soluble sodium salt taken out by water as before. The residual oil was now a limpid yellow liquid which still had the characteristic odour of the plant but the amount remaining, 0.02 grammes, was too small to examine further. The solutions of sodium salts, removed as described above, when acidified deposited a crystalline solid and some resin; both of low melting point but too small in amount to examine. The portion remaining in solution was converted into a silver salt and on ignition yielded 42.6 per cent. of silver. As the quantity of silver salt only amounted to a few milligrammes, this figure can only be a rough approximation but it may perhaps be taken as indicating the presence of lower fatty acids of about the complexity of octoic acid.

"These results may be summarised as follows. The fresh plant yields about 0.001 per cent. of volatile oil, which so far as can be judged from the results of the experiment possible with so minute an amount of oil, consists largely of free acids and esters with possibly some phenolic substance. The constituent to which the characteristic odour of the plant is due is not an acid ester or phenol since it persists after these constituents have been removed or decomposed."

The magnitude of the subject and the importance Mr. Dawe attaches to it are summed up in the two following extracts taken from Mr. Dawe's paper in *Tropical Life*, May 1922, where he also shows a photograph of the grass in its natural habitat :—

"It is, however, quite obvious that a project of such magnitude and importance as this could not be effectively carried out in any part of Africa without the sympathetic support and liberal assistance of the Government of the country. It is, further, a scheme that would have to be carried out on a very big scale to be effective."

"If the results of planting this grass as is herein outlined came up to the writer's expectations in such regions of Africa as those referred to, a work of the highest humanitarian importance will have been achieved for the people; for in the place of a decreasing population and vacant lands will grow up a healthy and thriving people, as well as a cattle industry which should contribute materially to the economic development and prosperity of the country. It is therefore that the writer considers this grass worthy of the fullest investigation and trial."

LXVII.—THE GOVERNMENT GARDENS, SOKOTO, NIGERIA.

In *Kew Bulletin*, 1921, p. 238, reference was made to the remarkable and valuable achievement of Dr. Bernard Moiser, Principal Medical Officer, Sokoto, in establishing the foundation of a botanic garden in so arid and unpromising a place as Sokoto, in the Northern Territories of Nigeria. It was hoped that Dr. Moiser would have been able to furnish an account of his work for publication in the *Bulletin*, but time has not permitted him to do so and therefore this brief notice has been compiled from notes he has supplied and from other sources.

His Excellency Sir Hugh Clifford, G.C.M.G., Governor of Nigeria, visited the Sokoto Gardens in the spring of this year and was very greatly impressed with the important results of Dr. Moiser's untiring efforts. So much was he convinced of the value of the undertaking that he addressed a minute on the gardens to the Chief Secretary to Government, Nigeria. His Excellency has been pleased, at the request of the Director, to permit his minute to be published in the *Bulletin*.

COPY OF HIS EXCELLENCY THE GOVERNOR'S MINUTE ON THE SOKOTO GARDENS.

"Chief Secretary to Government,

"During my recent stay at Sokoto I was very greatly struck by the really beautiful gardens which Dr. R. Moiser, the Senior



Scale 1 inch = 100 yards

Medical Officer, has brought into existence at that Station. These gardens are, and are intended to be, pleasure gardens, rather than botanical gardens; and though, therefore, they cannot compare, if regarded from the latter point of view, with the gardens at Victoria in the Cameroons Province, they are, in my opinion, much more charming and very much more pleasing and restful to the eye.

"2. Taking full advantage of a natural hollow, or long rather narrow valley, where the subterranean water-level is near to the surface of the soil, and which was already ornamented by a number of fine trees, Dr. Moiser, by means of some fairly elaborate landscape gardening, and by the most skilful and painstaking horticulture, has converted what must have been a patch of rank, green scrub, set in the midst of a sandy, straw-coloured wilderness, into one of the most charming gardens that I have seen anywhere in the Tropics. I cannot understand how it is that the fame of this really notable achievement, and of the horticultural enthusiast whose patience, skill and devotion to his task have accomplished it, has not spread broadcast throughout Nigeria; and it is with shame that I record the fact that I first received a detailed account of what Dr. Moiser had done from Sir David Prain, the Director of the Royal Botanic Gardens at Kew, in the Athenæum Club a week or two before I sailed for West Africa in November last. Dr. Moiser has here performed precisely the sort of service to Nigeria which is so very rarely rendered to the countries in which they serve by officers living in West Africa. He has, by his unassisted efforts, succeeded in adding immeasurably to the amenities and *agréments* of a station which, but for his horticultural work in it, would have possessed no special attractions. He has thereby raised the standard of comfort and of general living conditions for every European dweller in Sokoto; has given to each of them a really beautiful and shady place in which to congregate during their leisure hours; and has supplied them with something lovely and refreshing for eyes to rest upon that have grown weary with staring through the glare at the dusty, parched country that surrounds them. Incidentally he has shown what enterprise and skill and energy can achieve in West Africa, as in other parts of the tropical world, in the direction of rendering an unpromising environment as agreeable and pleasure-giving as the comfort and the well-being of Europeans dwelling in it demand.

"3. I shall be glad if you will cause a copy of this minute to be sent in due course to Dr. Moiser, through the D.M.S., together with an official expression of the thanks of the Government of Nigeria for the very notable work which he has done.

"4. I shall be glad, if you will be so good as to ask the Director of Forests to issue standing instructions to the Conservator of Forests for the time being having his headquarters at Sokoto, to assume personal charge of and responsibility for these gardens whenever Dr. Moiser is absent on leave. At

present, I understand, no permanent arrangements exist to insure Dr. Moiser's work being automatically carried on during his absence from the country.

" 5. Before proceeding on leave, Dr. Moiser should be asked to draw up detailed instructions for the management and maintenance of the gardens for the guidance of the officer of the Forestry Department who is about to assume charge of them, and the latter should be instructed strictly to abide by them.

" 6. I understand that during 1921-22 the sum of £100 was granted by the Lieutenant-Governor of the Northern Provinces to the Resident of Sokoto for the maintenance of these gardens from Head 8, Item 19—Miscellaneous Services, Assistance to Games Clubs. I think that in future a sum of not less than £150 *per annum* should be provided as a separate item under this head of the estimates, and named 'Upkeep of Government Gardens, Sokoto.' During the coming financial year this sum should be allocated from N.P. Head 8, Item 19, and I will, if necessary issue a Special Warrant later in the year to cover this expenditure.

" 7. I feel justified in approving this special expenditure, in spite of the straitened state of the finances of this Government, because I regard Sokoto, mainly owing to the existence of this garden, as one of the best places that it will be possible to select as a site for one of the recreation camps which this Government will have to bring into existence in Nigeria in order to afford to officers who are doing long tours of service under the new Leave Regulations the change of scene, &c., of which, from time to time, they stand in need. As Dr. Moiser has pointed out to me on the spot, it would be possible, for an expenditure of less than a thousand pounds, to lay out an almost perfect 18-hole golf-course, to make a large number of grass tennis-courts, and to supply a swimming-bath, the water in which would be as clear as crystal. It would also be possible for a very moderate sum to build and equip a large mud building for the accommodation of officers on local leave. When the road from Zaria to Sokoto, now under construction, has been completed, the journey to Sokoto will be easy of accomplishment by *char-à-banc* motor vehicles at all seasons of the year; and though for a few weeks during the dry season the midday heat is said to be intense, the nights are generally cool and often cold; and, as I can testify from personal experience, the change of climate from the muggy, damp atmosphere of the coast districts is exceedingly invigorating.

" 8. I do not regard this project as in any sense chimerical, and indeed, if the financial position to-day were other than it is, I should lose no time in giving immediate effect to it. The new Leave Regulations impose upon the Government certain well-defined obligations in the matter of providing facilities for officers desiring to take local leave; and, thanks to Dr. Moiser's successful demonstration of the potentialities of Sokoto,

I find in this place a satisfactory means of satisfying some of them.

(Sgd.) HUGH CLIFFORD,
Governor."

Funtua, Katsina Emirate,

Kano Province.

March 3rd, 1922.

The recognition afforded by His Excellency to Dr. Moiser's pioneer work at Sokoto will be welcomed by botanists and horticulturists throughout the Empire and nowhere more than at Kew, the centre of botanical enterprise in the British Empire. Of more importance is the assurance that the gardens, which represent the devotion and care of one man, are to be maintained, and it is to be hoped that the Government of Nigeria in the future will not only continue Sir Hugh Clifford's far-seeing policy, but will endeavour to develop and increase the value and importance of this Tropical African Garden, which is pregnant with such great possibilities. The gardens were made in the first instance by Dr. Moiser, from the point of view of public health, and thanks to the skill and knowledge of their founder they have not only amply realised this primary object but almost imperceptibly have become potential Botanic Gardens.

Were it possible to reproduce the many excellent photographs of the gardens sent by Dr. Moiser, it would be seen that the landscape effect has in no way been sacrificed to the more scientific aspects of the gardens and skilful use has been made of the existing trees to make the whole place not only "pleasant to the eye," but also "good for food," both to mind and body.

Dr. Moiser has made good grass lawns, which give the gardens a fine spacious effect, and despite the dry climate they are kept green without overhead watering. The sound expedient has been adopted of damming up the stream so that the water percolates through the soil and the grass is watered from below with most satisfactory results. (Plate III.)

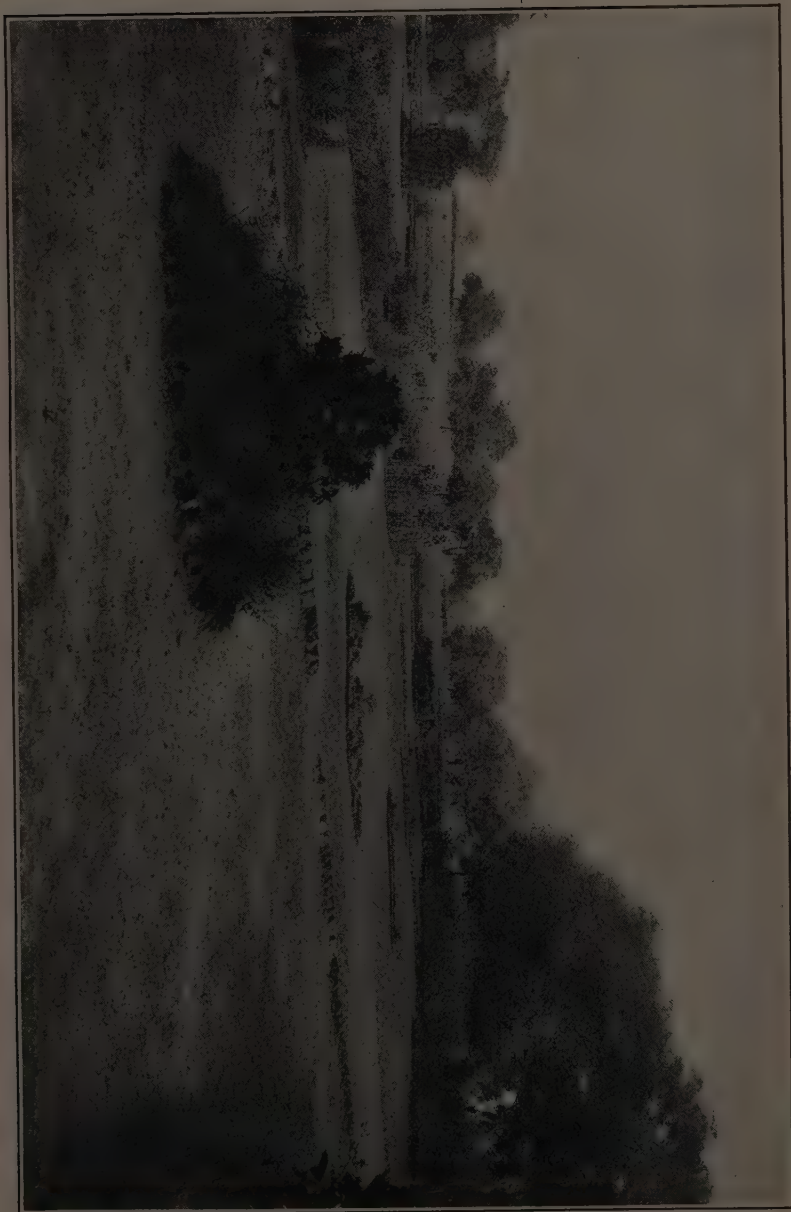
The garden, which was started in 1916, is fortunate in including the heads of two narrow valleys, in which the sub-soil water lies within a couple of feet of the surface, even at the driest time of the year, and in which some magnificent old *Vitex* and fig trees, as well as *Acacia* and locust-bean trees, not only lend their grandeur and grateful shade, but serve to keep out the scorching winds of the desert.

When making the garden, water-holes and swampy patches had to be drained, ditches dug, rank grass and weeds cleared away, and in so doing the place was cleared of snakes and mosquitoes, for it was the home of both.

Then a few gravelled walks were laid out, and a primitive bridge or two was put across the meandering stream, of crystal-clear water, cool and fresh from the springs.

The first object was to ensure a constant supply of English vegetables and to quote Dr. Moiser's words in "West Africa," of

PLATE III.



SOKOTO GARDENS. Grass lawn.



SOKOTO GARDENS. Flower beds.

July, 1922, p. 743: "Soon great white heads of cauliflowers, as much as 22 inches across, huge firm cabbages, glorious crisp lettuces, tomatoes by the 100, spinach, beetroot, carrots, beans, potatoes, marrows, cucumbers, melons, artichokes, parsley, endive, etc., bananas and guavas began to appear at table. The foregoing by no means exhausts the list, but they are sufficient to show what a variety can be grown. How easily and at what a pace they spring up and grow, and how jolly fit they keep one!" . . .

"But the garden was not to end with vegetables! That long open stretch of evergreen grass, never scorched or parched, was too good to let alone. The 'Dumpy' level was borrowed from the office, pegs put in, and a small army of labourers got on the job. The ground was simply dug up, and the soil moved, until a series of level lawns was created, badminton and croquet being the first games to be played. There was no sowing of grass seed required, the native 'dhub' and other varieties of grass simply sprang up through the bare soil from their old roots; rollers and lawn mowers had soon to be requisitioned, and in a few months we had beautiful smooth turf that would have put a lawn at home to shame. More bridges were constructed, ornamental ponds dug out and filled with water lilies, curving paths laid out, edgings of *Alternanthera* planted and kept neatly trim and clipped." (Plate IV.)

The present gardens cover about 35 acres, but there still remain some 200 or 300 acres of precisely similar ground, untouched, that at present serve no better purpose than grazing for cattle.

Various seeds were sent out from Kew last year to Dr. Moiser, by way of experiment, and it is interesting to learn that *Delphinium grandiflorum*, *Hunnemania fumarifolia*, *Phlox Drummondii* and *Helichrysums* were highly successful introductions, and produced sheets of colour.

This account, which betrays the spirit of the enthusiast who has made the desert blossom, represents, however, only one side of the work Dr. Moiser has so far achieved.

Throughout his enterprise, a Botanic Garden has been the goal of his aspirations, and the dream is undoubtedly becoming an actual fact. Here can be gathered together the economic and medicinal plants suitable for the country, and it should be possible to initiate and carry out experiments and researches which could not fail to prove of great benefit to the community generally.

Not only is the garden a place of refreshment from toil, but it has also great educational possibilities both for officials and natives. Among the latter, from enlightened Emirs to their intelligent Hausa subjects, there are many who would profit from the lessons which a garden of this sort can teach.

The Garden proper is not the culmination of Dr. Moiser's aspirations, for he writes:—

"I should dearly love to have a small Herbarium down in the Garden arched over the N. end of the Terrace, built in English style with mullioned windows and red tiles. It would fit in there admirably, and be really useful. Something of the sort is badly wanted, and away on the slope between the two valleys would stand the Museum and Laboratories, where science could be at work, and one could rest wearied eyes on cool spreading sward all round!"

A charming but no impossibly ideal picture in this otherwise barren and dry land.

We have learnt so much of the knowledge of plants possessed by the Hausa peoples from the labours of another distinguished medical officer, Dr. J. M. Dalziel, the author of the Hausa Dictionary, as well as from Dr. Moiser, and other collectors in Northern Nigera, that it is easy to realise that a small local Herbarium with a Museum and Laboratories, would be of very great value.

Dr. Moiser in his work at Sokoto is only repeating the old story of botanical enterprise, and teaching us, as in times past, how closely the sciences of Botany and Horticulture are linked with the sister science of Medicine.

XLVIII.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS.*—V.

J. BURTT DAVY.

61. *Brassica arvensis*, (L.) O. Ktze. in Act. Hort. Petrop. x. 164 (1887); and Rev. Gen. 19 (1891) non Linn. *Sinapis arvensis*, Linn.

SOUTH AFRICA. Transvaal: Pretoria, Aapjes River, occasional weed in grain-fields, *Leendertz* 3723!

The "Charlock," adventive from Europe, where it is a noxious weed.

62. *Brassica juncea*, (L.) Coss. in Bull. Soc. Bot. Fr. vi. 609 (1859).

SOUTH AFRICA. Transvaal: Zoutpansberg Distr.; Louis Trichardt, Dr. Breijer in 1919, in *Transv. Mus. Herb.*

Adventive from Asia. Cultivated in Egypt and Asia as an oil seed.

63. *Brassica pachypoda*, Thell. in Viert. Zurich Naturf. Gesell. Jahr. 56, Heft iii. 257 (1911). *Sinapis pendula*, E. Mey., Plant. Drèg. pp. 47, 48 (1843) nom. nud. *Sinapis retrorsa*, Sond. in Fl. Cap. i. 32, as regards the Natal plant, not of Burchell.

* Continued from *Kew Bulletin* 1921, p. 335.

SOUTH AFRICA. Transvaal: "Batlapin Country" (Bloemhof Distr.) *Holub*!; Pretoria, *Leendertz* 416! Louis Trichardt, *T.M.H.* 20872; Rustenburg, *T.M.H.* 9795; Johannesburg, *T.M.H.* 6159; Vereeniging, *T.M.H.* 10919; Standerton, *T.M.H.* 9935; Volksrust, *T.M.H.* 9933; Bethal, *T.M.H.* 9354. Natal: Phoenix, *Schlechter* 3146 (type); Port Natal, *Krauss* 412! Isipingo, "in cane fields," *J. M. Wood* 1004. Cape Province: Transkei: Bazeia, "weed in cultivated lands," 600 m. alt., *Baur* 375; Albany Div.; *Bolus* 1948; Fish River Heights, *Hutton*; *MacOwan* 955; Queenstown Div.; between Table Mt. and Zwartkei River, 1150-1400 m. *Drège*! (co-type of *Sinapis pendula*, *E. Mey.*)

Sonder, l.c., appears to have overlooked Meyer's name and to have confused the plant with *Sinapis retrorsa*, Burch.; the pods of the latter are quite different.

64. *Eruca sativa*, *Mill.*, Gard. Dict. ed., viii, No. 1 (1768); *Brassica Eruca*, *Linn.*

SOUTH AFRICA. Transvaal: Pretoria, *Burt Davy* 3076! Bloemhof Distr.; *Burt Davy*! Vereeniging Distr.; *Burt Davy* 15179! Sporadic in lucerne lands, introduced about 1904 with exotic agricultural seeds.

Cultivated in South Europe and Northern India as an oil seed, and in Europe as a salad under the name of "Roquette"; the young leaves are said to have somewhat the flavour of horseradish. It is eaten by pigs, and ostriches seem very fond of it. Reported as being hardy against frost in the Bloemhof District. Sometimes mistaken for *Raphanus sativus*, *Linn.* but differs in the more distinctly veined petals and the broad ensiform beak of the pod.

65. *Raphanus sativus*, *Linn.*, Sp. Pl. 669 (1753).

SOUTH AFRICA. Transvaal: Pretoria, Aapjes River, *Leendertz* 974! Cultivated, and occasionally met with as a garden escape. Sometimes confused with *Eruca sativa*, *Mill.*

66. *Arabis perfoliata*, *Lam.*, Encyc. i. 219 (1783).

SOUTH AFRICA. Cape Province: Aliwal North Div.; Wittebergen *Drège* 7537 (type) in herb. Sond.; Somerset East Div.; Boschberg, 1000 m. alt., Dec. 1886, *MacOwan* 702! "Kaffraria," on mountains, *Mrs. Barber* in 1867! Natal: Banks of the Mooi River, 1150 m. alt. *J. M. Wood* 4069! Transvaal: Ermelo Distr.; Goede Hoop Farm, *Mrs. Pott* 5134 in *T.M.H.*!

Apparently rare; found in the early days of settlement in Cape Colony, locally scattered over the eastern mountain region, but whether then alien or indigenous is not stated on collector's labels.

67. *Sisymbrium capense*, *Thunb.*, Prod. Pl. Cap. 109 (1800).

SOUTH AFRICA. Transvaal: a common weed of roadsides, vacant "erven" and gardens, in 1904, evidently adventive! Standerton, *Burt Davy* 896! Pretoria, *Burt Davy* 5557!

68. *Sisymbrium exasperatum*, *Sond.* in *Linnaea* xxiii. 3 (1850).

SOUTH AFRICA. Transvaal: Bloemhof Distr.; near Christiana, *Burt Davy* 12471!

69. *Sisymbrium Turezaninowii*, *Sond.* in *Fl. Cap.* i. 26 (1859-60) ex descr.

SOUTH AFRICA. Transvaal: Bloemhof Distr.; *Burt Davy* 11216! Standerton, *Rogers* 14805! Wakkerstroom Distr.; *Burt Davy* 5356!

I have not seen the type, which is at Trinity College, Dublin.

70. *Silene pendula*, *Linn.*, *Sp. Pl.* 418 (1753); *Bot. Mag.* t. 114.

SOUTH AFRICA. Transvaal: Witwatersrand; Bocksburg, Jan. 1916, *Dr. Breijer in T.M.H.* 15015! probably a "garden escape."

Native of Italy, Sicily and Crete. Cultivated in English gardens in 1790, and recommended for rock gardens.

71. *Acacia ataxacantha*, *DC.*, var. *australis*, *Burt Davy*, var. nov.; a forma typica foliis majoribus, pinnis multioribus differt; a *A. eriadeniae*, Benth. pinnis multioribus, foliolis minoribus, petiolis rhachidibusque saepe aculeatis, et habitibus differt.

SOUTH AFRICA. Transvaal: Pietersburg Distr.; Magoobas Kloof, Houtboschberg, *Burt Davy* 5231 type! Barberton Distr.; near Barberton, *Burt Davy* 292! 2770! *Pott* 5302! *Rogers* 23886! Swaziland; Forbes' Reef, outskirts of bush, *Burt Davy* 2730.

A scrambling or trailing shrub climbing with the aid of its prickles. *Stipules* deciduous. *Leaf-rhachis* 10-13 cm. long, armed or unarmed with prickles, usually without any gland above the petiole. *Pinnae* usually 5-20 pairs, about 3 cm. long. *Leaflets* 40-50 pairs, 3-6 mm. long, 0.5-1 mm. broad, somewhat falcate, obtuse, obliquely truncate at base, thinly pilose with scattered, appressed hairs, especially in the margins. *Legumes* bright purplish-red, produced in large clusters, conspicuous.

72. *Acacia Benthamii*, *Rochebr.*, *Tox. Afr.* ii. pl. xix. f. 15. *A. arabica* var. *kraussiana*, Benth. in *Hook. Lond. Journ. Bot.* i. 500 (1842).

NATIVE NAMES: Maawka (*Sesutu*); isi-Ngau or isi-Gnau (*Zulu*).

SOUTH AFRICA. Natal: (type locality), a dominant species in the thorns country near Camperdown, *Burt Davy* 10431! Transvaal! Delagoa Bay! Bechuanaland Protectorate! N'Gamiland.

The ripe pods smell sugary and are sweetish to the taste; though astringent, they are eagerly eaten by livestock. They contain about 20 per cent. of tannin, which is found suitable for certain kinds of work (*Sim*). According to Rochebrune, this

species contributed, at one time, a large part of the "gomme du Cap" of commerce; Sim states that this gum has occasionally been collected in the Tugela Valley, Natal, and sold . . . for the manufacture of confectionery. Tree up to 12 ins. in diameter; wood reddish, close-grained, hard, in Natal locally used for fuel (*Sim*); in the Waterberg District, Transvaal, the timber is found to be "extremely hard and durable, termite proof, and makes excellent fencing posts, equal to sneezewood" (*E. E. Galpin*).

73. **Acacia Borleae** *Burt Davy*, sp. nov.; affinis *A. permixta*, *Burt Davy*, sed ramulis rhachisque glandulosis nec hirsutis, foliolis multioribus brevioribus angustioribus minute mucronulatis pustulatis differt.

SOUTH AFRICA. Portuguese East Africa: Lourenco Marques, 18 Jan. 1920, *Mrs J. Borle* 271!

Shrub? with glutinous branchlets, petioles and peduncles. Spines straight, spreading 0.4–2.2 cm. long, grey with brownish tips, dotted with minute dark dots (glands?). *Leaves* and peduncles arising from reduced branchlets forming axillary cushions; petioles 0.5–1.5 cm. long; rhachis channelled, with 1 or 2 peltate glands at the base of the uppermost pinnae; pinnae 2–5 pairs, 2 cm. long; rhachilla channelled, leaflets about 2 mm. apart on the rhachilla, 2.5 mm. long, about 1 mm. broad, 6–13 pairs, oblong obtuse with a minute mucro, glabrous, the surface apparently pustular when fresh. *Peduncles* $2\frac{1}{2}$ – $3\frac{1}{2}$ cm. long, the involucre above the middle and apparently glandular; flowers capitate, yellow; receptacle, calyx and corolla glabrous; bracteoles 0; legume not seen.

74. **Acacia Burkei**, *Benth.* in *Lond. Journ. Bot.* v. 98. pl. xviii. fig. 4 (1846); *A. ferox*, *Benth.*, l.c. p. 97 pro parte, non *Mart. & Gal.* (1843).

Aapjes-doorn, or Haak-doorn.

NATIVE NAME: mKwarimpi (*Sesutu*).

SOUTH AFRICA. Transvaal: Pretoria Distr.; Magaliesberg, *Burke* 126! (type), 523 pro parte! *Zeyher* 570 pro parte! Waterberg Distr.; Potgietersrust, *Burt Davy* 5239! Nylstroom, *T.M.H.* 2983; between Nylstroom and the Springbok Flats, *Burt Davy* 1731!

As Miss Glover has pointed out (*Ann. Bolus Herb.* i. 151, 1915), the type specimens of *A. ferox*, *Benth.* are composed of specimens of *A. Burkei*, *Benth.* and *A. detinens*, *Burch.*, mounted on the same sheets; as representing a composite species, therefore, the name *A. ferox*, *Benth.* becomes a synonym; it is also antedated by *A. ferox*, *Mart. & Gal.*

75. **Acacia campylacantha**, *Hochst.* in *A. Rich. Fl. Tent. Abyss.* i. 242; *Schweinf. Pl. Nil.* t.l.; *A. Catechu*, *Oliv.* in *Fl. Trop. Af.* ii. 344, non *Willd.*; *A. Suma*, *Benth.*, *Monog. Mimos.* in *Trans. Linn. Soc.* xxx. 519 (1874), non *Ham.*

RANGE: Tropical Africa, from Abyssinia to the Northern Transvaal.

S. RHODESIA: Bank of the Zambesi River near Victoria Falls, 900 m. alt. *Rogers* 5120!; Zambesi River bank, "a large tree 40 to 68 ft. high, when in flower can be smelt half a mile off," native name "Mowphonfwwe," *C. E. F. Allen* 68!

N.W. RHODESIA: Kafue River, 6 miles below Kafue Bridge, 900 m. alt. (Chilenga name "Chombwe") *Rogers* 8658! Kasungula, a large shrub, fls. and frt. March, *Miss A. E. Gairdner* 430! Sesheke, Sept. 1860, *Dr. J. Kirk*!

NYASALAND: M'lange, 2500 ft., "tree 20-30 ft. high, flowers pale yellow, Oct." *Purves* 216!

PORTUGUESE E. AFRICA: Mozambique Territory; Shupanga on the Zambesi River, 1869 *Dr. Stewart*! Chibabava on the Buzi River, a large tree, bark hard, corrugated; fls. white *W. H. Johnson* 82! Zambesi River, N'Kueza, 12/4, 1860, between Tette and the sea coast, and near Senna, *Dr. J. Kirk*! *Swynnerton* 1242, from Gazaland, may also belong here.

SOUTH AFRICA. Extra-tropical Transvaal: Pietersburg Distr.; Middle Letaba River, at Buffels Road Drift, a large tree, June 9, 1906, *Burt Davy* 2547! Thabina River, June 15, 1906, known as "White Thorn," *Burt Davy* 2636!

In his Revision (*Trans. Linn. Soc.* xxx. 519, 520), Bentham observes that *A. Catechu*, Willd., *A. Suma*, Kurz. *A. hecatophylla*, Steud. and *A. caffra*, Willd., "are very difficult to distinguish from each other in dried specimens, and the synonymy is much confused. . . . It might be better, perhaps, to consider *A. Catechu* as a collective name, and to include in it *A. Roxburghii*, *A. Sundra*, *A. Suma*, *A. hecatophylla* and *A. caffra*." He decided, however, to limit the use of the name *A. Catechu* to one of the tropical Asiatic species, excluding from it all the African material which he placed under *A. Suma* and *A. caffra*.

In a MSS. note at Kew under *A. campylacantha*, Hochst., Prof. Craib notes that "the African plant comes very near to the Indian *Catechu* group, and in that group comes nearest to *A. Suma*, Ham. (vide Prain, *Journ. As. Soc. Beng.* lxi. 508. for Key to group), but is distinguished by its curved spines (the upper margin of spines in the Indian plant is *straight*, but in the African *curved*). The Nigerian plant is rather more robust than the Abyssinian, but intermediates are found in the Nyasa region. The Rhodesian plant agrees with some Nyasa specimens in being rather densely glandular."

On the Blue Nile, opposite Singa, the tree yields a good timber and is known as "Kakamut," in Arabic (*Muriel*).

In Bornu, Northern Nigeria, it yields the gum known as "Kolkol" (*K. F. Rae*) or "Kalkara"; in Yola the tree is known as "Cumbanchahon" and yields a "gum of good quality" (*B. E. B. Shaw*); according to Mr. G. C. Dudgeon, the tree is not uncommon on the Rogo road between Kano and Zaria, where it is known as "Massasagi."

76. *Acacia Galpinii*, *Burt Davy*, sp. nov.; affinis, *A. kwebense*, N.E. Br., sed foliis majoribus glabrescentibus glaucescent-

ibusque, pinnis 10–12 jugis, foliolis 17–27 jugis 7–8 mm. longis 1·5–2 mm. latis, leguminibus 20–22 cm. longis 2·7 cm. latis subfalcatis subcoriaceis differt.

Aapjes-doorn.

SOUTH AFRICA. Transvaal: Waterberg Distr.; banks of Bad-zyn-loop River, Mosdene Estate, Naboomspruit, 19 Sept., 1920, *E. E. Galpin* 483M, (type)!

Large tree, 40 ft. high, 4 ft. diam. at 6 ft. from the ground. *Spines* sharply hooked, in pairs at the base of the leaves. *Rhachis* with petiole 9–14 cm. long, glabrous, with a small raised gland below the lowest pair of pinnae; pinnae 3·5–5 cm. long, 8–10 mm. apart; leaflets \pm 2 mm. apart, obtuse, glabrous, glaucescent. *Spikes* 4–6 cm. long, racemously fascicled on short pubescent axillary branches. *Calyx-tube* shallow, purplish, subglabrous; flowers light yellow. *Pod* subcoriaceous, flat with a conspicuous margin.

77. *Acacia giraffae*, *Burch.*, Travels ii. t. 5 (1824).

The true Kameeldoorn.

NATIVE NAME: Mokáala (*Sechuana*).

SOUTH AFRICA: Griqualand West; Griquatown, *Burchell* 1952; Klarwater, *Burchell* 2402–3, (types)! Orange Free State! Transvaal! Bushmanland! Bechuanaland Protectorate! Damaraland!

The freshly dug roots give off a powerful urinous smell. The so-called “wooden flowers” of the Bechuanaland Protectorate—it is said—are sometimes produced on this tree (as well as on *Burkea africana*) by the haustoria of a parasitic *Loranthus* or *Viscum*. The pods are eaten by cattle and large game.

78. *Acacia heteracantha*, *Burch.*, Travels i. 389 (1822).

Umbrella-thorn, Bastard Kameel-doorn.

NATIVE NAME: Maawsu (*Sesutu*).

SOUTH AFRICA. Griqualand West: Spuigslangfontein; between the Orange River and Griquatown, *Burchell* 1710! (type). Herbert Division; western bank of the Vaal River, north of Backhouse, near Douglas, *J. Shaw*! Transvaal?

A flat-crowned tree about 20 ft. high, with “thick, clear single stem (frequently crooked),” up to 1½ ft. diameter. Flowers dirty whitish. Bracts medial or between the middle and base of the peduncle. Pod linear-falcate, “like that of *A. capensis*,” (*Burchell* mss.). (*A. karroo*, Hayne.)

Closely allied to *A. litakunensis*, *Burch.*, differing principally in the linear-falcate pods and medial bracts. This may be the “Zwaart Haak-doorn” or “Rooi wacht-n-bietje” of the Springbok Flats, Waterberg District, Transvaal, which is described as having a medium-dark, furrowed bark, and a red heartwood, the wood becoming very hard after drying, and making excellent durable posts; it is further said to be uncommon in black-turf soils.

I have not seen a single fruiting specimen of *A. heteracantha* and good fruiting material is much desired in order to ascertain whether it is more than a mere form or condition of *A. litakunensis*, Burch.

79. *Acacia karroo*, Hayne, Gewaechse x, t. 33 (1827); *A. horrida*, Harv. in Fl. Cap. ii. 281 (1861-62), non Willd.; *A. capensis*, Burch., Travels i. 195 (name only) 189 (figure) (1822).

Karoo-thorn, Doorn-boom, Zoet-doorn, Wittedoorn, "Mimosa."

NATIVE NAME: um-Nga.

SOUTH AFRICA. Cape Province: Central, Eastern and South-western Regions. "Karoo," *Lichtenstein*, (type); Richmond Div.; *Drège*! Griqualand West; *Burchell* 1953-1! Orange Free State! Transvaal! S. Rhodesia: Salisbury, *Eyles* 1908!

All the Natal material referred to *A. horrida*, Willd., which I have seen, belongs to *A. natalitia*, E. Mey., a closely allied species which differs in the more numerous pinnæ (4-7 pairs), narrower and more numerous leaflets, very pubescent rhachis and light-coloured (yellowish) bark.

The most widely-distributed species in South Africa, chiefly riparian (forming the outer zone of arborescent vegetation) or found where water occurs near the surface.

Acacia karroo is troublesome to eradicate from agricultural land as it coppices freely, forming clumps which flower and fruit freely at about 3 ft. high. On the Springbok Flats, Waterberg District, Transvaal, I have seen extensive patches of this coppice, but only on "black turf" soils, probably where the natives had abandoned old "gardens" for clean new "braks" (i.e. newly broken veld), which they do as soon as the lands become so weedy as to involve much labour for cleaning. Goats and other livestock eat the young foliage in early spring, before green grass is plentiful. The bush is cut for making dry hedges for kraals. The wood makes excellent fuel, but though hard and tough is now seldom used for other purposes than the roughest of farm uses (*Sim*); it is subject to attack by a borer, but according to Mr. Tudor J. Trevor, if soaked in water for six months it is not liable to attack. The gum (Hlaga) has been exported by the ton as Cape Gum, and is also used locally in confectionery (*Sim*). The bark is used for domestic tanning; the bast of young branches is tough and is used on farms in place of twine or rope. The flowers are very fragrant, hence the name "Zoet-doorn."

var. *transvaalensis*, Burt Davy, comb. nov.; *A. horrida*, var. *transvaalensis*, Burt Davy in Kew Bull. 1908, p. 158.

SOUTH AFRICA. Endemic to the Transvaal.

Approaches *A. natalitia*, E. Mey., but the rhachis and rhachilla are less densely pubescent; leaflets less numerous and broader. Most of the Transvaal specimens of *A. karroo*, Hayne, are slightly

pubescent, (as is also some of the Cape material), but much less prominently so than var. *transvaalensis*.

80. *Acacia litakunensis*, Burch., Travels ii. 452 (1824); *A. spirocarpoides*, Engl. in Engl. Bot. Jahrb. x. 23 (1888).

Umbrella-thorn, Haak-en-steek or Wit-haak-doorn.

NATIVE NAMES: Sassani (*Sesutu*), Moshu (*Sechuana*).

SOUTH AFRICA. British Bechuanaland: Litakun, 1812, Burchell 2205, (type)! 1912, Burt Davy! Griqualand West: Barkly Div.; near Espach's Drift, Burt Davy 9643. Bechuanaland Protectorate! Transvaal! N'Gamiland?

A somewhat gregarious, flat-crowned tree 15–20 ft. high, with smooth bark, closely allied to *A. heteracantha*, Burch., but with spirally-twisted pods, and bracts close to the base of the peduncle. Flowers creamy-white, "very sweetly scented." The tree yields a gum; the wood is considered to be fit only for fuel. In the Waterberg District of the Transvaal, the 'steenbok' are said to be very fond of the pods and also to eat the leaves; but cattle do not appear to eat the pods, as far as my observation goes, though very fond of those of *A. giraffae*, Burch., and *A. Benthamii*, Rochebr.

In the winter of 1912, the centenary of Burchell's visit, I went to Litakun, partly with a view to re-collecting *Acacia litakunensis*, Burch., in the type locality.

Three species of *Acacia* were common there, including the well-known *A. giraffae*, Burch. and *A. robusta*, Burch. There were also large, old trees of a flat-crowned species with dimorphic spines and much twisted pods which agrees with Burchell's description and figure and with the scrappy type-specimen of *A. litakunensis*, so there can be no doubt that it is the tree described by Burchell. It agrees also with *A. spirocarpoides*, Engl., which therefore becomes a synonym.

81. *Acacia natalitia*, E. Mey., Comm. Pl. Afr. Aust. 167 (1835 or 36).

Natal Thorn.

SOUTH AFRICA. Natal: umGeni, 100 m. alt., Drège (type!). Transvaal! Delagoa Bay!

Closely allied to *A. karroo*, Hayne, but distinguished by the narrower, more numerous leaflets, more numerous pinnae, and characteristically pale, yellowish bark, as compared with the dark brown, almost black bark of *A. karroo*.

Harvey's Key in Fl. Cap. ii. 279, classes *A. natalitia*, E. Mey., with *A. robusta*, Burch., as having "pods lanceolate-oblong, broad," though the specimens cited by Meyer, Bentham and Harvey, were not in fruit. The pods now available do not show affinity with *A. robusta*, Burch., but rather with *A. karroo*, Hayne.

Specimens from Shiloh, Queenstown Division, Baur! and Fish River, Albany Division, Schlechter 6107! may belong here, though apparently somewhat intermediate in character, but

more complete material is required in order to assign the specimens from these localities to their right place.

As is often the case with common plants, there is a scarcity in herbaria of material of the common "Doorn-boom" of the coastal region of the Cape, and this is required to delimit the range, and more clearly define the differences between the two species.

82. *Acacia permixta*, Burt Davy sp. nov.; affinis *A. Nebrownii*, Burt Davy, sed ramulis hirsutis, pinnis foliolisque multioribus, foliolis angustioribus, pedunculis longioribus et involucello sub medio posito, leguminibus distincte venosis differt.

SOUTH AFRICA. Transvaal: Waterberg District; Potgietersrust, April 12, 1906, a common shrub on low kopjes, Burt Davy 5230! (type).

Shrub branchlets stoutish, chestnut-brown, hispid with short spreading white hairs. *Spines* 0.5–2 cm. long, straight, slender, white with brownish tips, pubescent when young with scattered hairs. *Leaves* 2.5–3.5 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light-brown persistent spinulose stipules about 1 mm. long; petiole 0.5 cm. long, rhachis and rhachillae pilose, and with scattered blackish glands; pinnae 2–4 pairs; leaflets 5–8 pairs, about 2 mm. apart on the rhachilla, 4–5 mm. long, 1.5–2 mm. broad, with a distinct mucro, sparsely ciliate, thick, glabrescent, the veins not prominent. *Flowers* capitate. *Peduncle* (of mature fruit) 3–3.5 cm. long, pilose with white, spreading hairs, glandular; involucre $1\frac{1}{2}$ –2 cm. from the base, about 2 mm. long, cupular, lobed, sparsely pubescent, about 2 mm. long. *Legume* 3.5–4 cm. long, 1.2–1.4 cm. broad, slightly falcate, obuse; valves subcoriaceous, shining, prominently nerved towards the margins, sparsely glandular with dark, raised glands. *Seeds* circular, margin 1 mm. broad.—Confused with *A. glandulifera*, Schinz.

var. *glabra*, Burt Davy, var. nov.; a forma typica ramulis, petiolis, pedunculisque, glanduliferis nec hirsutis, leguminibus minoribus (3 cm. longis) angustioribus (6 mm. latis), differt.

Fijn-doorn.

SOUTH AFRICA. Transvaal: Waterberg District; Hoogbult farm, Naboomspruit, forming low thickets 3 ft. high, Galpin 475 M! (type). This may prove to be a distinct species when more complete material is available.

Acacia Nebrownii, Burt Davy, is based on *A. glandulifera*, Schinz, 1900, (not of S. Watson, 1890), the types of which are Fleck 484a from Great Namaqualand, and Fleck 480a from Tsoaxaub, Hereroland. In the Kew Bulletin for 1921, p. 50, writing in the absence of Transvaal and Swaziland material, I referred the plants there named *A. permixta* and *A. swazica*, to *A. Nebrownii*; specimens courteously lent by the Director of the Union Botanical Survey, show that three species and a

variety have been confused under the name *A. glandulifera*, Schinz.

83. *Acacia Rogersii*, Burt Davy, sp. nov.; affinis *A. swazicae*. Burt Davy, sed petiolis brevioribus, foliolis minoribus, pedunculis tenuioribus glabris vel parce glandulosis, involucellis minoribus ad pedem pedunculorum positis, calycibus corollisque brevioribus, et staminibus longioribus differt.

SOUTH AFRICA. Transvaal: Messina, Rogers 21843! (type).

Shrub? with slender glabrous dark brown branchlets. *Spines* 0.6-6 cm. long, somewhat arcuately spreading, slender, white, glabrous. *Leaves* 1.5-2 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light brown, persistent, spinulose stipules about 1 mm. long; petiole 0.5 cm. long, sparsely glandular; rhachis and rhachilla glabrous, winged; pinnae mostly 1 (rarely 2) pairs; leaflets 4-5 pairs, about 2 mm. apart, 2-5 mm. long, 2-3 mm. broad, obtuse or minutely mucronulate, glabrous, drying green; veins and veinlets not conspicuous. *Flowers* capitate, the heads about 1 cm. diameter when in flower. *Peduncle* (of flower) 1.2-1.5 cm. long, glabrous or minutely sparsely glandular with pale glands; involucre hidden at the base of the peduncle, about 1 mm. long. *Legume* not seen.

84. *Acacia stolonifera*, Burch., Travels ii. 241 (1824); *A. hebeclada*, DC., Prodr. ii. 451 (1825).

NATIVE NAME: Siki (*Sechuana*).

SOUTH AFRICA. Griqualand West: Ongeluk's-fontein, between Griquatown and Kuruman, Burchell 2138! (type of *A. stolonifera*, Burch.). British Bechuanaland: between New Litakun and the Moshowing River, Burchell 2267! (type of *A. hebeclada* DC.). Cape Province: Kimberley Division! Orange Free State! Transvaal! Great Namaqualand! N'Gamiland?

A very characteristic bush of the South Bechuanaland Region, forming a clump of coppice 1½-3 ft. high, and some yards in diameter. Burchell observes, i.e., that it is "remarkable from the circumstance of its trunk or stems running just beneath the surface of the earth, and from which arise a multitude of shoots or branches."

The name *A. hebeclada*, DC., being based on Burchell 2267, which was distributed by Burchell as his *A. stolonifera*, was from the first an unnecessary synonym.

A. stolonifera, Burch., also occurs as a shrub 4-6 ft. high, with a stout stem, and devoid of 'coppice,' a form so different in habit that Burchell himself entered his No. 2397, from Chue Spring, and No. 2402-1 ("a shrub 5 ft.") from British Bechuanaland, in his MSS Catalogue, as *A. heteracantha*, Burch., though these specimens are very different from his type of that species (i.e. Burchell 1710, from Klaarwater, Griquatown). As there does not appear, from the available material, to be any other difference between them, and as the ranges of the two forms overlap, it seems not unlikely that the coppice-like growth may

be the result of the cutting down of the main stem of trunk-forming specimens of one and the same species.

85. *Acacia swazica*, *Burt Davy*, sp. nov.; affinis *A. permixtae*, *Burt Davy*, sed ramulis tenuioribus sparse glandulosis nec hirsutis, petiolis longioribus, pinnis foliolisque paucioribus, foliolis majoribus remotioribus, venis venulisque prominentibus, rhachide et pedunculo sparse glanduloso, nec hirsuto differt; a *Acacia glandulifera*, Schinz, foliolis multioribus et majoribus pedunculis longioribus mucronatis, et pedunculo bracteato differt.

SOUTH AFRICA. Swaziland: near Bremersdorp, 66 m. alt., Jan. 5, 1905, a common bush, *Burt Davy* 3045! (type) in National Herb., Pretoria. Transvaal: Barberton Distr.; Singerton near Hectorspruit, 400 m. alt., Aug. 18, 1908, *Burt Davy* 8002! Barberton, *Pott* 5305! Komatipoort, *Schlechter* 11868! Consort Valley, *Galpin* 631!

Dwarf bush with slender glabrous sparsely glandular brown branchlets. *Spines* situate at the base of the leaves, 0.4–4 cm. long, very straight, slender, white, sometimes with brownish tips, glabrous. *Leaves* 2.5–4.5 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light-brown, persistent, spinulose stipules about 1 mm. long; petiole 1–1.5 cm. long sparsely glandular; rhachis and rhachilla glabrous, winged; pinnae 1–2 pairs; leaflets 4–6 pairs, about 4 mm. apart, 3–11 mm. long, 2.5–4.5 mm. broad, mucronulate, glabrous, drying brownish; veins and veinlets prominent or not conspicuous. *Flowers* capitate. *Peduncle* of fruit 3–3.5 cm. long sparsely glandular; involucrel about 1.5 cm. from the base, about 2 mm. long, cupular, toothed rather than lobed, glabrous, sometimes glandular ciliolate. *Legume* 2.5–4 cm. long, 1 cm. broad, slightly falcate and beaked; valves subcoriaceous, somewhat dull, prominently reticulate throughout, sparsely glandular with dark, raised glands. *Seeds* nearly circular, 5–6 mm. in diameter, including a margin 1–1.5 mm. wide.

Has been referred to *A. horrida* forma, from which it is at once distinguishable by the glandular petiole and rhachis, the smaller leaves, and the axillary peduncles which are either solitary or in pairs, not in terminal racemes.

86. *Acacia Woodii*, *Burt Davy*, sp. nov.; arbor magna, affinis *A. rehmannianae*, Schinz, sed leguminibus 14–15 cm. longis 1.7–2.5 cm. latis ligneis juvenis griseo-viridis maturatis fulvobrunneis nec reticulatis, differt.

SOUTH AFRICA. Natal: between Estcourt and Colenso, *J. Medley Wood* 3528! (type); near Ladysmith, *Burt Davy* in *Trans. Dep. Agric. Herb.* 4821! Cato Ridge, *Burt Davy* 10437? without precise locality, *Gerrard* 1700! Transvaal: Barberton Distr.; White River Settlement, *Burt Davy* 1502? (neither flowers nor pods; bark rugose, yellowish, corky, flaking off in irregular pieces).

Large widely branching tree with yellowish, flaking bark. *Branchlets* densely pubescent with yellowish spreading hairs, the young parts somewhat golden-tomentose. *Spines* short (4 mm. long) ascending, straight, subulate with a thickened base, pubescent. *Leaf-rhachis* 3.5–6.5 cm. long, pubescent; petiole 4 mm. long. *Pinnæ* 8–25 (rarely up to 35) pairs, 2 cm. long; leaflets 25–40 pairs, silky ciliate, 3–5 mm. long, 1–1.5 mm. broad. *Peduncles* 2.5–3 cm. long, pubescent, axillary and solitary or in pairs, often collected in terminal racemes on short lateral branchlets; involucre usually rather above (rarely below) the middle, prominent, persistent. *Receptacles* without golden-yellow hairs; bracteoles of receptacle 2 mm. long, cucullate, pale coloured, glabrous within, hairy with a tuft of usually golden-yellow hairs; claw linear, ciliate. *Calyx-lobes* whitish-tomentose. *Pod* 14–15 cm. long, 1.7–2.5 cm. thick, with rounded margins, woody, dehiscent, grey-green when young, yellowish-brown when mature, glabrous.

87. ***Kissenia spathulata***, R. Br. ex Harv. et Sond., Fl. Cap. ii. 503. *Fissenia capensis*, R. Br., Harv. Thes. i. t. 98.

Harvey, l.c., cites the Aapjes River, Transvaal, as one of the localities for this species, on the strength of a specimen collected by Dr. Atherstone. The plant is a native of Bushmanland, Namaqualand and Arabia (if the reference of the South African plant to the Arabian species is correct), a distribution which renders it unlikely that such a very distinct desert type should occur in the vicinity of the Aapjes River, in the relatively well-watered Pretoria District. Atherstone is known to have collected along the Aapjes River, near Pretoria, which fact probably misled Harvey, but the label on Atherstone's Kew specimen of *Kissenia* reads:—"From sandy flats near the An Aap River which runs into the Orange R., Namaqualand"; the Aapjes River does not flow into the Orange, and it is not in, nor near Namaqualand. We may therefore eliminate *Kissenia spathulata*, R.Br., and with it the Family *Loasaceae*, from the list of Transvaal plants.

88. ***Flaveria contrayerba***, Pers., Syn. ii. 489 (1807).

SOUTH AFRICA. Griqualand West: Barkly Div.; Fourteen Streams Railway Station, a few plants by the railway track near the goods shed, April 1, 1920, *Burt Davy* 18966!

Native of South America (Peru and Chile). An interesting addition to the South African flora, and one which may possibly become a troublesome weed if allowed to spread.

89. ***Gomphrena decumbens***, Jacq., Hort. Schoenbr. t. 482.

SOUTH AFRICA. Transvaal: Heidelberg Distr., Vereeniging, a common weed of roadsides, railway tracks, and waste places, 1908, *Burt Davy*! Burttholm, a garden weed, 1914, but not common *Burt Davy*! Pretoria Distr.; Haaman's Kraal, 1903, *Burt Davy* 1099! Waterberg Distr.; Potgietersrust, Leendertz 1888! Rustenburg Distr.; Rustenburg, *Nation* 180! Barberton Distr.; Barberton, in 1903, *Burt Davy* 274!

TROPICAL AFRICA. Southern Rhodesia: Salisbury Distr.; Makabusi Valley, *Eyles* 590! Salisbury, *Mrs. O. Craster* 182! Umtali Distr.; Odzani River Valley, *Teague* 418! Belgian Congo: Katanga Province; Mokambo Station, on the railway track, Aug. 1919, *Burt Davy* 18086!

Native of Mexico, the West Indies and Tropical America, now widely distributed in the Transvaal Province and rapidly spreading along roads and railways to Rhodesia and the Katanga Plateau.

It keeps fairly green late in the winter, and is closely eaten by stock in late autumn and early spring. Either green or dry, it is a favourite with horses, mules and donkeys, but the yield of pasturage is low and it is somewhat inaccessible, owing to the decumbent habit of the plant.

It differs from *G. globosa*, Linn.—with which it has been confused—in habit and the much smaller, less globose heads which elongate during flowering, and by its usually white bracts. The true *G. globosa*, Linn., with larger, more globose heads and tawny bracts, has been found in Natal and tropical Africa, but does not appear to occur in the Transvaal, the specimens so named (Fl. Cap. v. 1. 433) from the Transvaal proving to be *G. decumbens*, Jacq.

Jacquin's figure is not quite characteristic of our plant, which, however, agrees exactly with tropical American material so named in the Kew collections, and I have no doubt that they are conspecific.

90. *Cryptocarya transvaalensis*, *Burt Davy* sp. nov.; (Lauraceae-Cryptocaryeae]; *C. liebertianae*, Engl., affinis, sed petiolis brevioribus, foliis longioribus angustioribusque, nervis lateralibus infimis adscendentibus margine approximatis vel confluentibus, venulis minute reticulatis utrinque prominentibus, costis tenuioribus nec vel paullo prominentibus, inflorescentibus multifloris, floribus latioribus, perianthium lobis erectis, receptaculis latioribus, differt.

Large tree the leaf-buds and petioles fulvo-pubescent when young, soon becoming glabrous. *Leaves* 6–9·5 cm. long, 2–3 (rarely 4·5) cm. broad, oblong-lanceolate to ovate oblong, tapering at both ends or rounded below, abruptly obtuse to sub-acuminate, coriaceous, green above, glaucescent beneath, minutely and somewhat prominently punctulate-reticulate on both surfaces; midrib very prominent above; lateral nerves faint, not prominently elevated beneath, 5–7 on each side, the lowest pair very oblique, arising at the base close to the margin and sometimes merging with it, the second pair also very oblique. *Petiole* 3–5 mm. long, channelled above. *Panicles* terminal and axillary at the ends of the branchlets, densely many-flowered; pedicels 1–2 mm. long. *Flowers* when open, 3·3–3·5 mm. long, 2 mm. broad, pubescent; receptacle 1·5–2 mm. long; perianth-lobes 1·5–2 mm. long, erect, not incurved, finely pubescent within. *Fruit* 1·75 cm. long, 1·5 cm. in diameter crowned by the short

persistent cylindrical neck of the receptacle, not ribbed, glabrous when dry wrinkled and dark red-brown.

Wild Quince.

NATIVE NAMES: Mootagoola-sode or Moozagu (*Modjadjes* Natives), Moeqwequlipala (*Sesutu*).

SOUTH AFRICA. Transvaal: Pietersburg Distr.; a common tree of the Mist-belt forests of the Houtboschberg, 1200–1700 m. *Burt Davy* 5096! (type), 5094! 5209!; *A. J. O'Connor*, Nov. 1913, in flower, 1465, and Oct. 1916, in ripe fruit, 2081, both in Forest Dept. Herb.; Modjadjes Mt., *Burt Davy* 5272!: Lydenburg Distr.; Pilgrim's Rest, in Van der Merwe Bush, *Burt Davy* 5210!; Sabie-hoek Forest, *Burt Davy* 5290! in For. Dept. Herb. 353; Forest near Pilgrim's Rest, *Grenfell*, Forest Dept. Herb. 352!

The wood is said to be "useful."

XLIX.—LIST OF PUBLICATIONS BY THE LATE G. MASSEE.

In the last paragraph of the obituary notice of the late Mr. G. Massee, published in *K.B.* 1917, p. 85, a reference is made to the preparation of a list of his papers to be published at a later date. The list which has had to be held over for some time has now been completed.

1867.

British Woodpeckers (*Picus*). *Intellectual Observer*, xi. pp. 321–325, 1 col. pl.

1877.

Phyllotaxis. *Nature*, xvi., p. 208.

1880.

Notes on some of our smaller Fungi. *Science Gossip*, 1880, pp. 7–9, 84–86, 224–226, 6 text-figs.

On the germination of the spores of *Spumaria alba*. (Notice of a communication to the Liverpool Microscopical Society.) *Amer. Monthly Microsc. Journ.*, i. p. 240.

1882.

Notes on *Puccinia graminis*. *Naturalist*, vii. pp. 191–195.

Note on the germinating sporidia of *Valsa leiphemia*, Fr. *Journ. Bot.*, xx. pp. 310–311.

1883.

A gossip about Fungi. *Science Gossip*, 1883, pp. 227–229, 252–256, 23 text figs.

1884.

Description and life-history of a new Fungus, *Milowia nivea*. Journ. R. Microsc. Soc., ser. 2, iv. pp. 841-845, 1 pl.

On the formation and growth of cells in the genus *Polysiphonia*. Journ. R. Microsc. Soc., ser. 2, iv. pp. 198-200, 1 pl.

1885.

New British Micro-Fungi. Journ. R. Microsc. Soc., ser. 2, v. pp. 757-760, 1 pl.

1886.

Notes on the structure and evolution of the *Florideae*. Journ. R. Microsc. Soc., ser. 2, vi. pp. 561-573, 1 pl.

On the structure and functions of the subterranean parts of *Lathraea squamaria*, L. Journ. Bot., xxiv. pp. 257-262, 1 pl.

British *Pyrenomycetes*. A preliminary list of known species. Grevillea, xv. pp. 1-9, 33-39, 68-72, 116-121; xvi. pp. 12-14, 34-39, 117-120; xvii. pp. 4-6, 57-58, 73-75; xviii. pp. 8-12, 40-42, 57-60, 89-90; xix. pp. 12-14, 42-44 (1886-90).

1887.

Revision of *Polysaccum*. Grevillea, xvi. pp. 27-29; xvi. p. 76 (1887-88.).

Disease of *Colocasia* in Jamaica. Journ. Linn. Soc., xxiv. pp. 45-49, 1 pl.

On *Gasterolichenes*; a new type of the group *Lichenes*. Phil. Trans. R. Soc. Lond., ser. B, clxxviii. pp. 305-309, 1 col. pl.; abstract in Proc. R. Soc. Lond., xlii. p. 370.

On causes influencing the direction of growth, and the origin of multicellular plants. Journ. Bot., xxv. pp. 257-266, 1 pl.

On the differentiation of tissues in Fungi. Journ. R. Microsc. Soc., 1887, pp. 205-208, 1 pl.

A monograph of the genus *Lycoperdon* (Tournef.) Fr. Journ. R. Microsc. Soc., 1887, pp. 701-727, 2 pl.

Two Fungi from Gaboon (by M. C. Cooke and G. M.). Grevillea, xv. p. 111.

1888.

A monograph of the genus *Calostoma*, Desv. Ann. Bot., ii. pp. 25-44, 1 col. pl.

On the presence of sexual organs in *Aecidium*. Ann. Bot., ii. pp. 47-50, 1 col. pl.

A revision of the genus *Bovista*. Journ. Bot., xxvi. pp. 129-137, 1 pl.

On the type of a new order of Fungi, *Matula poroniaeforme*, Mass. Journ. R. Microsc. Soc., 1888, pp. 173-176, 1 pl.

Unsolved problems in plant life. (Abstract). Essex Naturalist ii. pp. 259-261.

1889.

How to commence the study of botany. (Abstract.) *Essex Naturalist*, iii. 1889, p. 238.

A monograph of the British *Gastromycetes*. *Ann. Bot.*, iv. pp. 1-103, 4 pl.

A monograph of the *Thelephoreae*. Part I. *Journ. Linn. Soc.*, xxv. pp. 107-155, 3 pl. Part II. *L.c.*, xxvii. pp. 95-204, 3 pl. (1889-90).

A revision of the *Trichiaceae*. *Journ. R. Microsc. Soc.*, 1889, pp. 325-359, 4 pl.

A new development of *Ephelis* (by M. C. Cooke and G. M.). *Ann. Bot.*, iii. pp. 33-39, 1 pl.

On *Erysiphe polychaeta*, B. & C., and *Uncinula polychaeta*, B. & C. *Grevillea*, xvii. pp. 76-78.

Collecting and preserving fleshy Fungi (by M. C. Cooke and G. M.). *Kew Bull.*, 1889, pp. 257-259.

1890.

Mycological notes. *Journ. Mycol.*, v. pp. 184-187, 1 pl.; vi. pp. 178-184, 1 pl. (1890-91).

A monograph of the genus *Podaxis*, Desv. (*Podaxon*, Fries). *Journ. Bot.*, xxviii. pp. 33-39, 69-77, 2 pl.

Fungi of Madagascar, collected by Mr. Scott Elliot (by M. C. Cooke and G. M.). *Grevillea*, xviii. pp. 49-51.

1891.

British Fungi. *Phycomycetes* and *Ustilagineae*. London, 8vo, pp. xv and 232, 8 pl.

A new genus of *Tubercularieae* (*Hobsonia*, Berk.). *Ann. Bot.*, v. p. 509.

A new *Cordyceps* [*C. Sherringii*, Mass.]. *Ann. Bot.*, v. pp. 510-511.

Sarcomyces, new genus. *Grevillea*, xx. pp. 13-14.

New or imperfectly known *Gastromycetes*. *Grevillea*, xix. pp. 94-98.

New Fungi from Madagascar (collected by R. Baron). *Journ. Bot.*, xxix. pp. 1-2, 1 pl.

The plant world. London, 8vo, pp. x and 212, 56 figs.

The evolution of plant life; lower forms. London, 8vo, pp. viii and 242, 38 figs.

A *Primula* disease, *Ramularia Primulae*, Thuem. *Gard. Chron.*, ser 3, x. p. 626, 1 text-fig.

Life-history of a stipitate Freshwater Alga (*Dictyosphaerium*). *Journ. Linn. Soc.*, xxvii. pp. 457-462, 1 pl.

1892.

British Fungus-Flora. A classified text-book of Mycology. London, 8vo. Vol. i. 1892, pp. xii and 432; vol. ii. 1893, pp. vii

and 460; vol. iii. 1893, pp. viii and 512; vol. iv. 1895, pp. viii and 522; text-figs.

A monograph of the *Myxogastres*. London, 8vo, pp. 367, 12 col. pl.

Vanilla disease (*Calospora Vanilla*, Mass.). Kew Bull., 1892, pp. 111-120; 1 pl.

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L.—MISCELLANEOUS NOTES.

MR. GERALD ATKINSON has been appointed by the Minister of Agriculture and Fisheries, as from 11th September 1922, Artist in the Herbarium at Kew, in succession to Mr. Arthur Kellett. Mr. Atkinson received his training at the School of Art, Hull.

WE record with great regret, as this number goes to the printers, the deaths of Sir ISAAC BAYLEY BALFOUR, F.R.S., late Regius Keeper of the Royal Botanic Gardens, Edinburgh, and HENRY JOHN ELWES, F.R.S. Notices of their contributions to botanical science will appear in the next number of the Bulletin.

The Botanical Magazine.—After the lapse of nearly two years we welcome the new issue of Curtis's Botanical Magazine, which has for so long been closely associated with the Royal Botanic Gardens.

The termination of the Fourth Series with the final part of Vol. XVI. was announced in the Bulletin for 1920, pp. 373, 374, and now after a long and anxious period it is being issued once more in its familiar cover, but under the auspices of the Royal Horticultural Society who have become the new Proprietors.

The Editorship has passed from the hands of the Director into those of Dr. O. Stapf, F.R.S., the late Keeper of the Herbarium and Library, and the Society is to be congratulated on having secured the services of so eminent a botanist for this important scientific undertaking. To Kew also the choice of Editor is a welcome one, since the long connection between Kew and the Magazine will continue much as in the past.

The new part—Part I. of Vol. CXLVIII., published by Messrs. H. F. & G. Witherby—is in every way excellent. The Plates as in former years are very well drawn, but the reproduction and colouring are greatly improved and the Plates are now comparable to those of the Magazine at its best.

The figures are the work of three artists, Miss Smith, Mr. Kellett, lately artist at Kew, and Miss Snelling, artist to the Magazine. They show both beauty of design and great accuracy of detail. The plants figured are *Jasminum rex*, Dunn (t. 8934) a remarkable pure white Jasmine from Siam; the dwarf *Rhododendron Williamsianum*, Rehder & Wilson (t. 8935), from Western China; *Podanthum floribundum*, Stapf (t. 8936), an interesting new species, here described for the first time, from Asia Minor which promises to be a garden plant of value; *Mesembrianthemum fragrans*, Salm Dyck (t. 8937) from South Africa; *Aeschynanthus sikkimensis*, Stapf (t. 8938) from India, also a new species. The plant figured was collected by Mr. Elwes near Darjeeling, and has brilliant flowers.

The next subjects are *Primula Sinolisteri*, Balf. f. (t. 8939) allied to *P. Listeri*, King and *P. obconica*, Hance, a native of South Western China; *Stapelia tsomoensis*, N. E. Brown (t. 8940),

a remarkably good figure of this fine S. African succulent; *Philadelphus sericanthus*, Koehne (t. 8941) from Central China; *Rhododendron Baileyi*, Balf. f. (t. 8942) found by Capt. F. M. Bailey in 1913 in the upper Nyamjang Valley, South Tibet; *Bulbophyllum triste*, Reich. f. (t. 8943) from India; *Symphytum grandiflorum* D.C. (t. 8944) an interesting and hardy pale yellow symphytum from the Caucasus, and *Phellodendron Lavalleyi*, Dode (t. 8945) a deciduous nutaceous tree with panicles of black grape-like fruits from Japan.

It is interesting to learn that there will be no break in the continuity of the series of the Magazine. The volume for the year 1921 is being prepared by private enterprise and will be issued in the same style as the old and present numbers, and will it is hoped shortly be published.

The Ferns of Bombay.*—A small octavo volume forming a convenient pocket guide to the wild and cultivated ferns of Bombay. The sequence followed is that of Hooker & Baker's Synopsis Filicum. It should not be difficult with the aid of the synopsis of the 54 genera, which comes at the end of the volume, and of the keys to the species which are found with each genus, for anyone, even without a previous botanical training, to find out the names of the local ferns. The systematic part is preceded by an introduction dealing shortly with the structure and life history of ferns. The letterpress is clearly printed and the figures should prove useful.

S. T. D.

Food of the Gold Coast People.†—It is not often that the scientist living and working in little-known countries devotes his attention to the everyday practices of the native. It is therefore all the more interesting that we find in Dr. Dalziel's observations and analysis of the daily food of the native races of the Gold Coast a well reasoned report which may prove of great assistance to those whose duty it is to administer to the personal welfare of the natives and to the whiteman seeking to discover what is of value in the native foodstuffs. After a few introductory remarks on the general nature and variety of the foodstuffs employed, Dr. Dalziel cites typical diets of different local races and then proceeds to discuss relative and actual values of the foods in use. Of these the chief Cereals are Rice, Maize and Guinea-corn. In commenting on the food values of Peas and Beans he mentions that the general prejudice against pulses or leguminous seeds is well established on the Gold Coast. The crops discussed are Cow-pea (*Vigna Catjang*),

* The Ferns of Bombay pp. viii, 228, with 2 coloured, 15 black and white plates and 43 text figures, by E. Blatter and J. F. d'Almeida. Taraporevala Sons & Co., Bombay. Price Rs. 7/8/-.

† J. M. Dalziel, M.D., B.Sc., F.L.S., Deputy Director, Sanitary Services, Gold Coast, in The Journal of the Gold Coast Agricultural and Commercial Society; vol. i. No. 4, 1922. Published by the Society, Accra: price 6d.

the Bambarra Ground-nut or Round Single-seeded Earth Pea (*Voandzeia subterranea*), the Pigeon or Congo Pea (*Cajanus indicus*), Soya Beans (*Glycine Soja*), and Ground-nuts (*Arachis hypogaea*). Of other vegetables used as food he refers to the Tiger-nut (*Cyperus esculentus*), Yams and Coco-yams, Okros, Spinach, Garden Eggs, Sweet Potato and the introduced *Sechium edule* and *Cucurbita moschata*, but though the use of vegetables is so general he states "that it is by no means certain that they form a sufficient proportion, or that their properties are not largely lost in cooking." His criticism of the few fruits in cultivation and their poor variety indicates perhaps a larger field for improvement than in respect to any other kind of diet. In his conclusions he considers the relative value of introduced foods such as bread and comments on the surprising indifference to eggs and milk. The relation of the diet as a whole to deficiency diseases and stomach and bowel disorders so prevalent in the country, is discussed with the comment that "Gold Coast diets are, for most individuals, not deficient in quantity, but there is much reason to believe that in quality, or in lack of some one or more essential elements, there may be tissue starvation, to which many of the gastro-intestinal disorders, which afflict the people are due." He summarises the chief defects of the present diets and deplores the increasing consumption of tinned food which, "with the increasingly popular white bread, without admixture of local foodstuffs, would be the ruin of the people." His recommendations are that "reliance on the country's own Cereals, Maize Guinea-corn and home-grown rice, to the exclusion of imported polished kinds, is to be developed. Fruit and Market Gardening and the more abundant use of fresh vegetables should be inculcated. These, along with more attention to the production of larger quantities of poultry are to be commended in the interests of the people themselves, whether living on the land or labouring for others."

Spartina Townsendii* at Clevedon, Somerset.—A further report from Miss Ida M. Roper after a visit to Clevedon on the 28th September of this year leaves little doubt that the experiment of planting *Spartina* as a mud-binder in the hope of raising the river flats below Clevedon has not proved the success that had been anticipated. The tidal race has proved too strong and although the original clumps have continued to hold out in some places they have been swept away elsewhere and, except in a few sheltered spots, failed to unite. Miss Roper remarks as follows.

"It is much to be regretted that this trial planting of *Spartina* must be considered to have become derelict. Whilst the individual clumps at the North East part appear this season to be healthy and bearing flowers well, they have not increased either in number or in size, and there is a broken or ragged

* For previous accounts see *Kew Bull.*, 1918, p. 26, and 1919, p. 391.

appearance in the bands and outer line that shows the mud is not being retained on the shore. The big rise and fall of the tides produce a distinct hollow round each clump, whereby the young shoots mostly perish before reaching across to take root in the mud. The scattered clumps nearer the bank suffer in a similar way and do not join up.

"Close to the mouth of the River Kenn there is an increase in the number of separate clumps, but they were washed to that part originally, and the first severe storm is likely to carry all of them away.

"Over the remainder of the flats to the South West for over a mile there is scarcely a clump left, except a few in the three sheltering bights, and as this is the stretch which it was intended chiefly to benefit by the planting of *Spartina* for shore raising purposes, the experiment must be regarded as a failure."

Malay Poisons and Charm Cures.*—The greater part of the recent edition of Dr. Gimlette's book deals with methods of poisoning, of charms, medicine men and the origin of poisons from animal and inorganic sources. Chapters VIII. and IX. and Appendix II. are devoted to plants. In Chapter VIII. nineteen of the principal jungle plants and trees are described with notes on their administration as poisons and, in many cases, the effects actually observed. The best known of these are the Rengas tree (*Stagmaria* and *Melanorrhora* spp.), so often noticed as the solitary standing tree on jungle clearings, and whose juices are reported to have a blistering effect similar to that of the "mustard gas" used in the war; the Upas climber, species of *Strychnos*, and the Upas tree, *Antiaris toxicaria*, both so well known as furnishing the principal poison for darts and arrows.

Chapter IX. contains descriptions of twelve groups of plants cultivated in and around villages for their medicinal and poisonous properties. The uses of *Datura* and Tuba, in particular, are described at length and amongst the others used in compounding poisons it is interesting to note the Papaya, Pepper, Pinang, Pineapple and Ginger.

The value of the book as a work of reference to be consulted is considerably impaired by the abbreviation of the Index in which botanical names and economic uses are only occasionally given. In this respect it cannot be considered to be an improvement on the first edition. It is, however, a work that should find a place in every scientific library, as so many sciences are reviewed in connection with the practices of an interesting people well versed in jungle lore, and from whom we may well expect to learn some of the secrets of nature.

* Malay Poisons and Charm Cures, by John D. Gimlette, M.R.C.S., L.R.C.P. J. and A. Churchill, London, 1923. 2nd Ed., 8s. 6d.

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